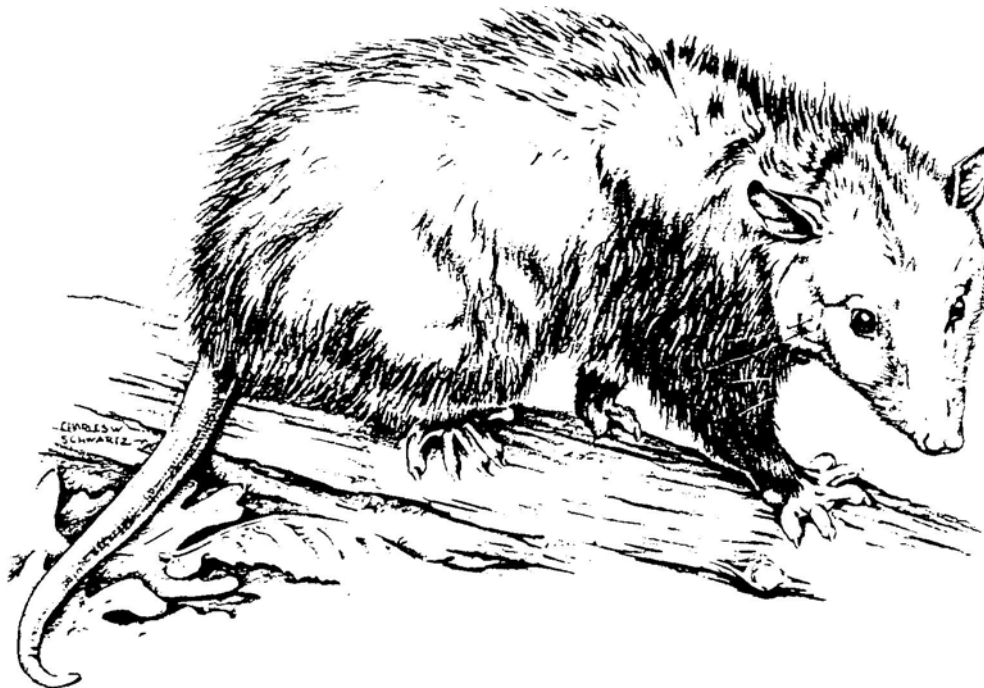


OPOSSUMS

Fig. 1. Opossum, *Didelphis virginiana*



Damage Prevention and Control Methods

Exclusion

Practical where opossums are entering structures.

Habitat Modification

Remove cover and plug burrows to reduce frequency of visits by opossums.

Frightening

Generally not practical.

Repellents

None are registered.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Shooting

Effective where firearms are permitted. Use a shotgun with No. 6 shot or a .22-caliber rifle.

Identification

An opossum (*Didelphis virginiana*) is a whitish or grayish mammal about the size of a house cat (Fig. 1). Underfur is dense with sparse guard hairs. Its face is long and pointed, its ears rounded and hairless. Maximum length is 40 inches (102 cm); the rat like tail is slightly less than half the total length. The tail may be unusually short in northern opossums due to loss by frostbite. Opossums may weigh as much as 14 pounds (6.3 kg); males average 6 to 7 pounds (2.7 to 3.2 kg) and females average 4 pounds (1.8 kg). The skull is usually 3 to 4 inches (8 to 10 cm) long and contains 50 teeth — more



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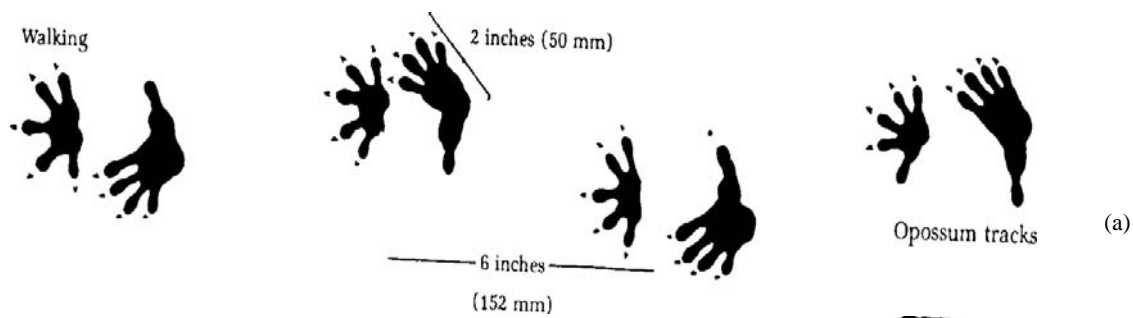


Fig. 2. Opossum sign and characteristics: (a) tracks, (b) droppings, and (c) skull.

than are found in any other North American mammal. Canine teeth (fangs) are prominent. Tracks of both front and hind feet look as if they were made by little hands with widely spread fingers (Fig. 2). They may be distinguished from raccoon tracks, in which hind prints appear to be made by little feet. The hind foot of an opossum looks like a distorted hand.

Range

Opossums are found in eastern, central, and west coast states. Since 1900 they have expanded their range northward in the eastern United States. They are absent from the Rockies, Sierra Nevada axis, most western plains states, and parts of the northern United States (Fig. 3).

Habitat

Habitats are diverse, ranging from arid to moist, wooded to open fields. Opossums prefer environments near streams or swamps. They take shelter in burrows of other animals, tree cavities, brush piles, and other cover. They sometimes den in attics and garages where they may make a messy nest.

Food Habits

Foods preferred by opossums are animal matter, mainly insects or carrion. Opossums also eat considerable amounts of vegetable matter, especially fruits and grains. Opossums living near people may visit compost piles, garbage cans, or food dishes intended for dogs, cats, and other pets.

General Biology, Reproduction, and Behavior

Opossums usually live alone, having a home range of 10 to 50 acres (4 to 20 ha). Young appear to roam randomly until they find a suitable home range. Usually they are active only at night. The mating season is January to July in warmer parts of the range but may start a month later and end a month earlier in northern areas. Opossums may raise 2, rarely 3, litters per year. The opossum is the only marsupial in North America. Like other marsupials, the blind, helpless young develop in a pouch. They are born 13 days after mating. The young, only 1/2 inch (1.3 cm) long, find their way into the female's pouch where they each attach to one of 13 teats. An average of 7 young are born. They remain in the pouch for 7 to 8 weeks. The young remain with the mother another 6 to 7 weeks until weaned.

Most young die during their first year. Those surviving until spring will breed in that first year. The maximum age in the wild is about 7 years.

Although opossums have a top running speed of only 7 miles per hour (11.3 km/hr), they are well equipped to escape enemies. They readily enter burrows and climb trees. When threatened, an opossum may bare its teeth, growl, hiss, bite, screech, and exude a smelly, greenish fluid from its anal glands. If these defenses are not successful, an opossum may play dead.

When captured or surprised during daylight, opossums appear stupid and inhibited. They are surprisingly

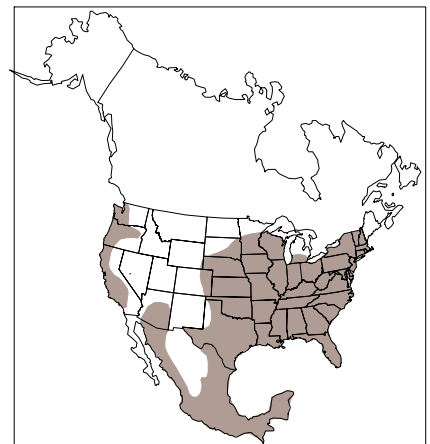
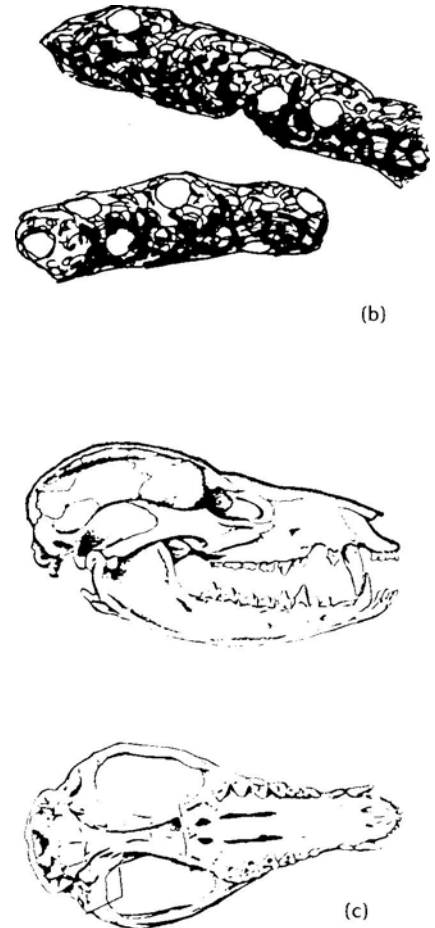


Fig. 3. Range of the opossum in North America.

intelligent, however. They rank above dogs in some learning and discrimination tests.

Damage

Opossums may be a nuisance near homes where they may get into garbage, bird feeders, or pet food. They may also destroy poultry, game birds, and their nests.

Legal Status

The opossum is designated as a nongame mammal in California.

See California statutes and regulations regarding the take of furbearing and nongame mammals.

Damage Prevention and Control Methods

Exclusion

Prevent nuisance animals from entering structures by closing openings to cages and pens that house poultry. Opossums can be prevented from climbing over wire mesh fences by installing a tightly stretched electric fence wire near the top of the fence 3 inches (8 cm) out from the mesh. Fasten garbage can lids with a rubber strap.

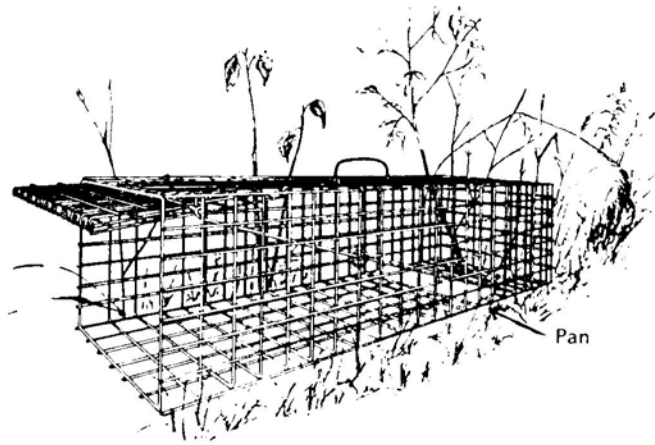


Fig. 4. Cage trap (set position).

Traps

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Opossums are not wary of traps and may be easily caught with suitable-sized box or cage traps (Fig. 4).

A medium-sized body-gripping (kill type) trap will catch and kill opossums. Place bait behind the trap in such a way that the animal must pass through the trap to get it. Body-gripping traps kill the captured animal quickly. To reduce chances of catching pets, set the trap above ground on a running pole (Fig. 6).

In California, it is illegal to use body-gripping traps for recreation or commerce in fur.

Shooting

A rifle of almost any caliber or a shotgun loaded with No. 6 shot or larger will effectively kill opossums. Use a light to look for opossums after dark. If an opossum has not been alarmed, it will usually pause in the light long enough to allow an easy shot. Once alarmed, opossums do not run rapidly. They will usually climb a nearby tree where they can be located with a light. Chase running opossums on foot or with a dog. If you lose track, run to the last place where you saw the animal. Stop and listen for the sound of claws on bark to locate the tree the animal is climbing.

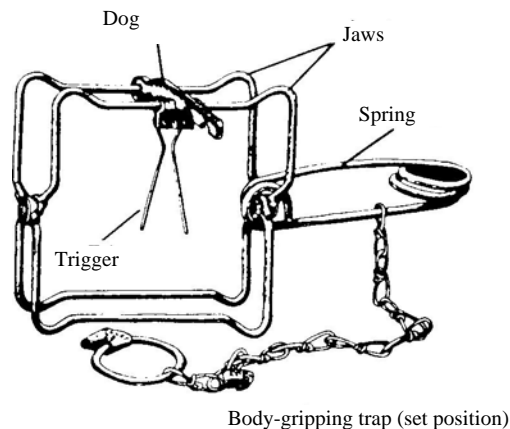
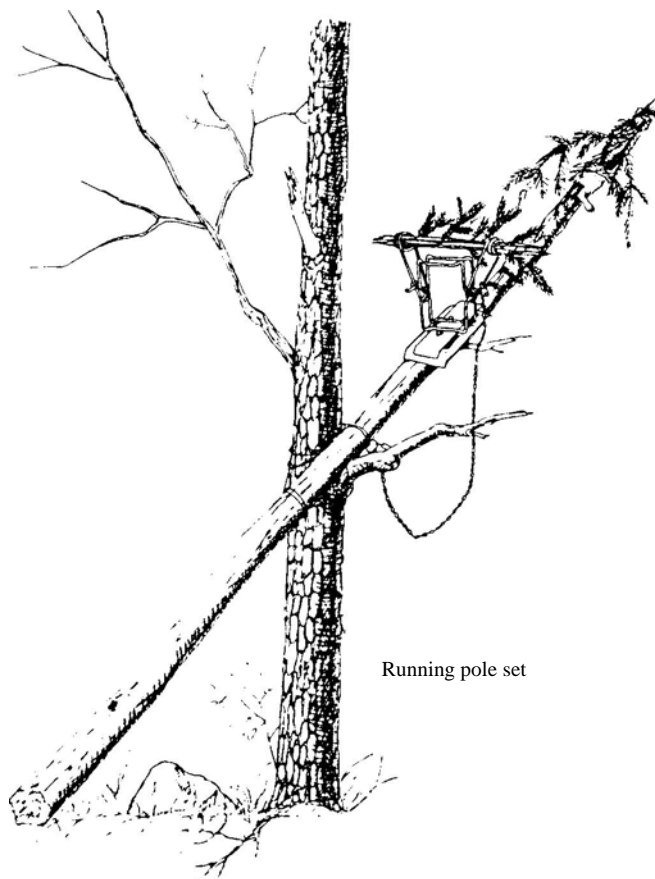


Fig. 6. Body-gripping trap and running pole set.

Economics of Damage and Control

No data are available; however, it is usually worthwhile to remove a particular animal that is causing damage.



Acknowledgments

Much of the information on habitat, food habits, and general biology comes from J. J. McManus (1974) and A. L. Gardner (1982). The manuscript was read and improved by Jim Byford and Robert Timm.

Figures 1, 2a, 2c, and 3 from Schwartz and Schwartz (1981).

Figure 2b by Jill Sack Johnson.

Figures 4 and 6 by Michael D. Stickney, from the New York Department of Environmental Conservation publication "Trapping Furbearers, Student Manual" (1980), by R. Howard, L. Berchielli, C. Parsons, and M. Brown. The figures are copyrighted and are used with permission.

For Additional Information

Fitch, H. S., and L. L. Sandidge. 1953. Ecology of the opossum on a natural area in northeastern Kansas. Univ. Kansas Publ. Museum Nat. Hist. 7:305-338.

Gardner, A. L. 1982. Virginia opossum. Pages 3-36 in J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore, Maryland.

Hall, E. R., and K. R. Kelson. 1959. The mammals of North America, Vol. 1. Ronald Press Co., New York. 546 pp.

Hamilton, W. J., Jr. 1958. Life history and economic relations of the opossum (*Didelphis marsupialis virginiana*) in New York State. Cornell Univ. Agric. Exp. Sta. Memoirs 354:1-48.

Howard, R., L. Berchielli, C. Parsons, and M. Brown. 1980. Trapping furbearers, student manual. State of New York, Dep. Environ. Conserv. 59 pp.

Lay, D. W. 1942. Ecology of the opossum in eastern Texas. J. Mammal. 23:147-159.

McManus, J. J. 1974. *Didelphis virginiana*. Mammal. Species 40:1-6.

Reynolds, H. C. 1945. Some aspects of the life history and ecology of the opossum in central Missouri. J. Mammal. 26:361-379.

Schwartz, C. W., and E. R. Schwartz. 1981. The wild mammals of Missouri, rev. ed. Univ. Missouri Press, Columbia, 356 pp.

Seidensticker, J., M. A. O'Connell, and A. J. T. Johnsingh. 1987. Virginia opossum. Pages 246-263 in M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ontario Ministry Nat. Resour. Toronto.

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RACCOONS

Fig. 1. The distinctively marked raccoon (*Procyon lotor*) is usually found in association with water.



Damage Prevention and Control Methods

Exclusion

Usually the best method for coping with almost all types of raccoon damage.

Habitat Modification

Remove obvious sources of food or shelter around the premises; usually not practical as a sole method of controlling damage.

Frightening

Several methods may be effective, but only for a short time.

Repellents, Toxicants, and Fumigants

None are registered.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Shooting

Can be very effective, particularly if trained hounds are used to tree the raccoons. Local regulations may apply.

Identification

The raccoon (*Procyon lotor*), also called "coon," is a stocky mammal about 2 to 3 feet (61 to 91 cm) long, weighing 10 to 30 pounds (4.5 to 13.5 kg) (rarely 40 to 50 pounds [18 to 22.5 kg]). It is distinctively marked, with a prominent black "mask" over the eyes and a heavily furred, ringed tail (Fig. 1). The animal is a grizzled salt-and-pepper gray and black above, although some individuals are strongly washed with yellow. Raccoons from the prairie areas of the western Great Plains are paler in color than those from eastern portions of the region.



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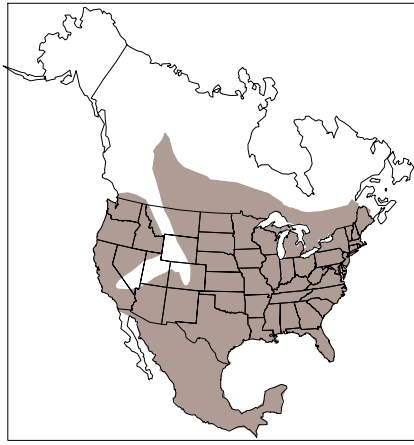


Fig. 2. Distribution of the raccoon in North America.

Range

The raccoon is found throughout the United States, with the exception of the higher elevations of mountainous regions and some areas of the arid Southwest (Fig. 2). Raccoons are more common in the wooded eastern portions of the United States than in the more arid western plains.

Habitat

Raccoons prefer hardwood forest areas near water. Although commonly found in association with water and trees, raccoons occur in many areas of the western United States around farmsteads and livestock watering areas, far from naturally occurring bodies of permanent water. Raccoons den in hollow trees, ground burrows, brush piles, muskrat houses, barns and abandoned buildings, dense clumps of cattail, haystacks, or rock crevices.

General Biology, Reproduction, and Behavior

Raccoons are omnivorous, eating both plant and animal foods. Plant foods include all types of fruits, berries, nuts, acorns, corn, and other types of grain. Animal foods are crayfish, clams, fish, frogs, snails, insects, turtles and their eggs, mice, rabbits, muskrats, and the eggs and young of ground-nesting

birds and waterfowl. Contrary to popular myth, raccoons do not always wash their food before eating, although they frequently play with their food in water.

Raccoons breed mainly in February or March, but matings may occur from December through June, depending on latitude. The gestation period is about 63 days. Most litters are born in April or May but some late-breeding females may not give birth until June, July, or August. Only 1 litter of young is raised per year. Average litter size is 3 to 5. The young first open their eyes at about 3 weeks of age. Young raccoons are weaned sometime between 2 and 4 months of age.

Raccoons are nocturnal. Adult males occupy areas of about 3 to 20 square miles (8 to 52 km)², compared to about 1 to 6 square miles (3 to 16 km)² for females. Adult males tend to be territorial and their ranges overlap very little. Raccoons do not truly hibernate, but they do "hole up" in dens and become inactive during severe winter weather. In the southern United States they may be inactive for only a day or two at a time, whereas in the north this period of inactivity may extend for weeks or months. In northern areas, raccoons may lose up to half their fall body weight during winter as they utilize stored body fat.

Raccoon populations consist of a high proportion of young animals, with one-half to three-fourths of fall populations normally composed of animals less than 1 year in age. Raccoons may live as long as 12 years in the wild, but such animals are extremely rare. Usu-

ally less than half of the females will breed the year after their birth, whereas most adult females normally breed every year.

Family groups of raccoons usually remain together for the first year and the young will often den for the winter with the adult female. The family gradually separates during the following spring and the young become independent.

Damage and Damage Identification

Raccoons may cause damage or nuisance problems in a variety of ways, and their distinctive tracks (Fig. 3) often provide evidence of their involvement in damage situations.

Raccoons occasionally kill poultry and leave distinctive signs. The heads of adult birds are usually bitten off and left some distance from the body. The crop and breast may be torn and chewed, the entrails sometimes eaten, and bits of flesh left near water. Young poultry in pens or cages may be killed or injured by raccoons reaching through the wire and attempting to pull the birds back through the mesh. Legs or feet of the young birds may be missing. Eggs may be removed completely from nests or eaten on the spot with only the heavily cracked shell remaining. The lines of fracture will normally be along the long axis of the egg, and the nest materials are often disturbed. Raccoons can also destroy bird nests in artificial nesting structures such as bluebird and wood duck nest boxes.

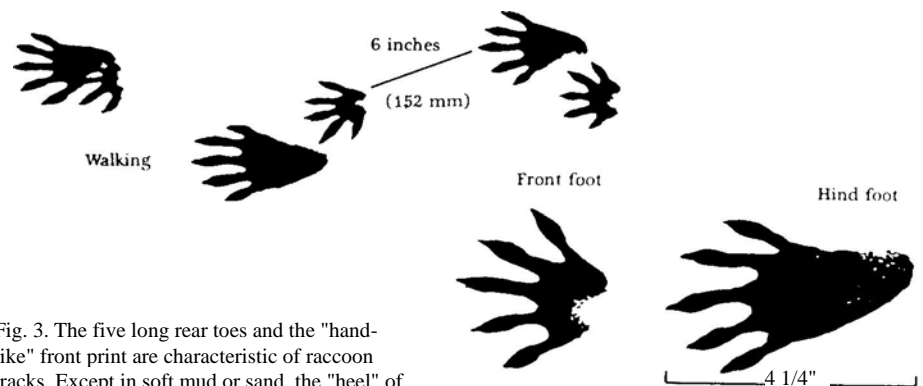


Fig. 3. The five long rear toes and the "hand-like" front print are characteristic of raccoon tracks. Except in soft mud or sand, the "heel" of the hind foot seldom shows.

Raccoons can cause considerable damage to garden or truck crops, particularly sweet corn. Raccoon damage to sweet corn is characterized by many partially eaten ears with the husks pulled back. Stalks may also be broken as raccoons climb to get at the ears. Raccoons damage watermelons by digging a small hole in the melon and then raking out the contents with a front paw.

Raccoons cause damage or nuisance problems around houses and outbuildings when they seek to gain entrance to attics or chimneys or when they raid garbage in search of food. In many urban or suburban areas, raccoons are learning that uncapped chimneys make very adequate substitutes for more traditional hollow trees for use as denning sites, particularly in spring. In extreme cases, raccoons may tear off shingles or fascia boards in order to gain access to an attic or wall space.

Raccoons also can be a considerable nuisance when they roll up freshly laid sod in search of earthworms and grubs. They may return repeatedly and roll up extensive areas of sod on successive nights. This behavior is particularly common in mid- to late summer as young raccoons are learning to forage for themselves, and during periods of dry weather when other food sources may be less available.

The incidence of reported rabies in raccoons and other wildlife has increased dramatically over the past 30 years. Raccoons have recently been identified as the major wildlife host of rabies in the United States, primarily due to increased prevalence in the eastern United States.

Legal Status

In California, raccoons are designated as furbearing mammals.

See California statutes and regulations regarding the take of furbearing and nongame mammals.



Fig. 4. Electric fencing can be very effective at excluding raccoons from sweet corn or other crops. Two wires are recommended, but one wire 6 inches above the ground may be sufficient. Electric fence chargers are available at farm supply dealers. The fence can be activated at dusk and turned off after daybreak.

Damage Prevention and Control Methods

Exclusion

Exclusion, if feasible, is usually the best method of coping with raccoon damage.

Poultry damage generally can be prevented by excluding the raccoons with tightly covered doors and windows on buildings or mesh-wire fences with an overhang surrounding poultry yards. Raccoons are excellent climbers and are capable of gaining access by climbing conventional fences or by using overhanging limbs to bypass the fence. A "hot wire" from an electric fence charger at the top of the fence will

greatly increase the effectiveness of a fence for excluding raccoons.

Damage to sweet corn or watermelons can most effectively be stopped by excluding raccoons with a single or double hot-wire arrangement (Fig. 4). The fence should be turned on in the evening before dusk, and turned off after daybreak. Electric fences should be used with care and appropriate caution signs installed. Wrapping filament tape around ripening ears of corn (Fig. 5) or placing plastic bags over the ears is an effective method of reducing raccoon damage to sweet corn. In general, tape or fencing is more effective than bagging. When using tape, it is important to apply the type with glass-yarn filaments embedded within so that the

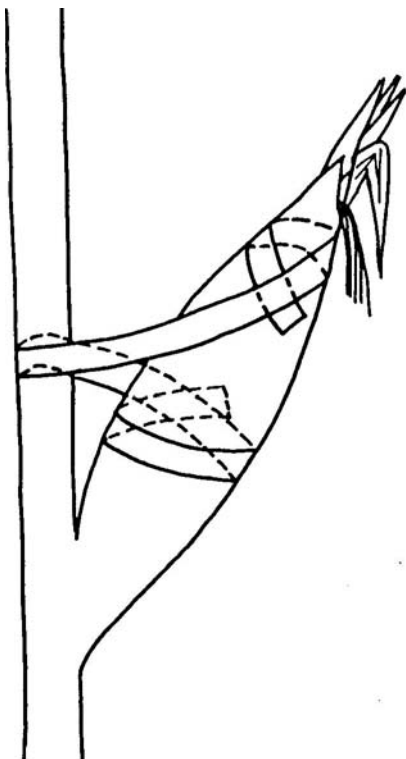


Fig. 5. Wrapping a ripening ear of sweet corn with reinforced filament tape as shown can reduce raccoon damage by 70% to 80%. It is important that each loop of the tape be wrapped over itself so that it forms a closed loop that cannot be ripped open by the raccoon.



Fig. 6. A cap or exclusion device will keep raccoons and other animals out of chimneys. These are available commercially and should be made of heavy material. Tightly clamp or fasten them to chimneys to prevent raccoons from pulling or tearing them off.

raccoons cannot tear through the tape. Taping is more labor-intensive than fencing, but may be more practical and acceptable for small backyard gardens.

Store garbage in metal or tough plastic containers with tight-fitting lids to discourage raccoons from raiding garbage cans. If lids do not fit tightly, it may be necessary to wire, weight, or clamp them down to prevent raccoons from lifting the lid to get at garbage. Secure cans to a rack or tie them to a support to prevent raccoons from tipping them over.

Prevent raccoon access to chimneys by securely fastening a commercial cap of sheet metal and heavy screen over the top of the chimney (Fig. 6). Raccoon access to rooftops can be limited by removing overhanging branches and by wrapping and nailing sheets of slick metal at least 3 feet (90 cm) square around corners of buildings. This prevents raccoons from being able to get a toehold for climbing (Fig. 7). While this method may be practical for outbuildings, it is unsightly and generally unacceptable for homes. It is more practical to cover chimneys or other areas attracting raccoons to the rooftop or to remove the offending individual animals than to completely exclude them from the roof.

Homeowners attempting to exclude or remove raccoons in the spring and summer should be aware of the possibility that young may also be present.

Do not complete exclusion procedures until you are certain that all raccoons have been removed from or have left the exclusion area. Raccoons frequently will use uncapped chimneys as natal den sites, raising the young on the smoke shelf or the top of the fireplace box until weaning. Homeowners with the patience to wait out several weeks of scratching, rustling, and chirring sounds will normally be rewarded by the mother raccoon moving the young from the chimney at the time she begins to wean them. Homeowners with less patience can often contact a pest removal or chimney sweep service to physically remove the raccoons. In either case, raccoon exclusion procedures should be completed immediately after the animals have left or been removed.

Habitat Modification

There are no practical means of modifying habitat to reduce raccoon depredations, other than removing any obvious sources of food or shelter which may be attracting the raccoons to the premises. Raccoons forage over wide areas, and anything other than local habitat modification to reduce raccoon numbers is not a desirable technique for reducing damage.

Raccoons sometimes will roll up freshly laid sod in search of worms or grubs. If sodded areas are not extensive, it may be possible to pin the rolls

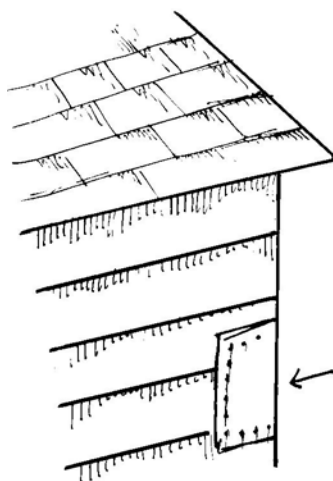


Fig. 7. Raccoon access to rooftops can be eliminated by pruning back overhanging limbs and tacking slick sheets of metal at least 3 feet square around corners of buildings.

down with long wire pins, wooden stakes, or nylon netting until the grass can take root, especially if the damage is restricted to only a portion of the yard, such as a shaded area where the grass is slower to take root. In more rural areas, use of electric fences may be effective (see section on exclusion). Because the sod-turning behavior is most prevalent in mid- to late summer when family groups of raccoons are learning to forage, homeowners may be able to avoid problems by having the sod installed in spring or early summer. In most cases, however, removal of the problem raccoons is usually necessary.

Frightening

Although several techniques have been used to frighten away raccoons, particularly in sweet corn patches, none has been proven to be effective over a long period of time. These techniques have included the use of lights, radios, dogs, scarecrows, plastic or cloth streamers, aluminum pie pans, tin can lids, and plastic windmills. All of these may have some temporary effectiveness in deterring raccoons, but none will provide adequate long-term protection in most situations.

Repellents

There are no repellents, toxicants, or fumigants currently registered for raccoon control.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Raccoons are relatively easy to catch in traps, but it takes a sturdy trap to hold one. For homeowners with pets, a live or cage-type trap (Fig. 8) is usually the preferable alternative to a leghold trap.

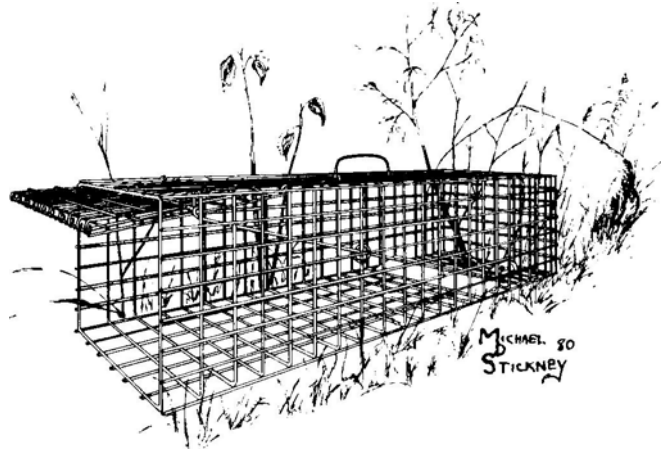


Fig. 8. A cage-type live trap, although bulky and expensive, is often the best choice for removing raccoons near houses or buildings where there is a likelihood of capturing dogs or cats.

Traps should be at least 10 x 12 x 32 inches (25.4 x 30.5 x 81.3 cm) and well-constructed with heavy materials. They can be baited with canned fish-flavored cat food, sardines, fish, or chicken. Place a pile of bait behind the treadle and scatter a few small bits of bait outside the opening of the trap and just inside the entrance. Traps with a single door should be placed with the back against a wall, tree, or other object. The back portion of the trap should be tightly screened with one-half inch (1.3 cm) or smaller mesh wire to prevent raccoons from reaching through the wire to pull out the bait.

Conibear®-type body-gripping traps are effective for raccoons and can be used in natural or artificial cubbies or boxes. Because these traps do not allow for selective release of nontarget catches, they should not be used in areas where risk of nontarget capture is high. Box traps should be used in those situations instead. It is possible, however, to use body-gripping traps in boxes or on leaning poles so that they are inaccessible to dogs (Figs. 9 and 10).

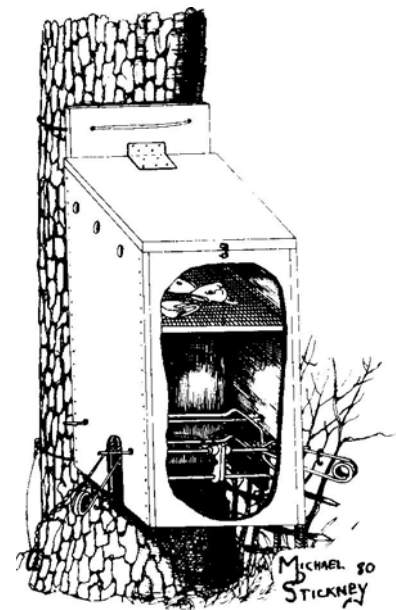


Fig. 9. A "raccoon box" is suspended 6 inches above the ground and is equipped with a Conibear®-type trap. Suspended at this level, this set is dog-proof.

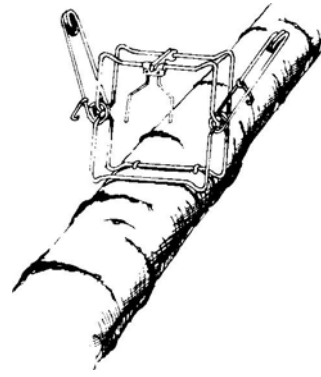
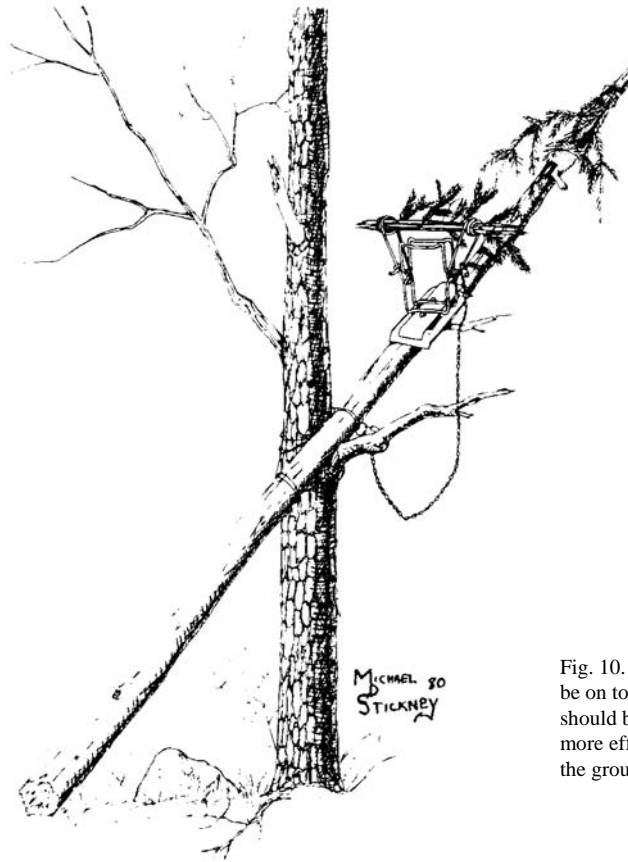


Fig. 10. The leaning-pole set for raccoons is another dog-proof set. The trigger should be on top to prevent the trap from being sprung by squirrels or chipmunks. Bait should be beyond the trap and covered so that it cannot be seen by birds. The set is more effective if a few drops of fish oil or other lure are placed along the pole from the ground level up to the trap.

Shooting

Raccoons are seldom seen during the day because of their nocturnal habits. Shooting raccoons can be effective at night with proper lighting. Trained dogs can be used to tree the raccoons first. A .22-caliber rifle will effectively kill treed raccoons.

Economics of Damage and Control

Statistics are unavailable on the amount of economic damage caused by raccoons, but the damage may be offset by their positive economic and aesthetic values. In 1982 to 1983, raccoons were by far the most valuable furbearer to hunters and trappers in the United States; an estimated 4.8 million raccoons worth \$88 million were harvested. Raccoons also provide recreation for hunters, trappers, and people who enjoy watching them. Although raccoon damage and nuisance problems can be locally severe, widespread raccoon control programs are not justifiable, except perhaps to prevent the spread of raccoon rabies. From a cost-benefit and ecological standpoint, prevention practices and specific control of problem individuals or localized populations are the most desirable alternatives.

Acknowledgments

Although information for this section came from a variety of sources, I am particularly indebted to Eric Fritzell of the University of Missouri, who provided a great deal of recently published and unpublished information on raccoons in the central United States. Information on damage identification was adapted from Dolbeer et al. 1994.

Figures 1 through 3 from Schwartz and Schwartz (1981).

Figures 4, 6, and 7 by Jill Sack Johnson.

Figure 5 from Conover (1987).

Figure 8 by Michael D. Stickney, from the New York Department of Environmental Conservation publication *Trapping Furbearers, Student Manual* (1980), by R. Howard, L. Berchielli, G. Parsons, and M. Brown. The figures are copyrighted and are used with permission.

For Additional Information

Conover, M. R. 1987. Reducing raccoon and bird damage to small corn plots. *Wildl. Soc. Bull.* 15:268-272.

Dolbeer, R. A., N. R. Holler, and D. W. Hawthorne. 1994. Identification and control of wildlife damage. Pages 474-506 *in* T. A. Bookhout, ed. *Research and management techniques for wildlife and habitats*. The Wildl. Soc. Bethesda, Maryland.

Kaufmann, J. H. 1982. Raccoon and allies. Pages 567-585 *in* J. A. Chapman and G. A. Feldhamer, eds. *Wild mammals of North America: biology, management and economics*. The Johns Hopkins Univ. Press, Baltimore, Maryland.

Schwartz, C. W., and E. R. Schwartz. 1981. *The wild mammals of Missouri*, rev. ed. Univ. Missouri Press, Columbia. 356 pp.

Sanderson, G. C. 1987. Raccoon. Pages 486-499 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. *Wild furbearer management and conservation in North America*. Ontario Trappers Assoc., North Bay.

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SKUNKS



Fig. 1. Left, the striped skunk, *Mephitis mephitis*; right, the spotted skunk, *Spilogale putorius*

Damage Prevention and Control Methods

Exclusion

Buildings: close cellar and outside basement and crawl space doors; seal and cover all openings including window wells and pits.

Poultry yards: install wire mesh fences.

Beehives: elevate and install aluminum guards.

Habitat Modification

Removal of garbage, debris, and lumber piles.

Frightening

Lights and sounds are of limited value.

Repellents

Some home remedies such as moth balls or flakes or ammonia solution may be useful, but no repellents are registered.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Shooting

Practical only when animals are far from residential areas.

Other Methods

Skunk removal.
Odor removal.

Identification

The skunk, a member of the weasel family, is represented by four species in North America. The skunk has short, stocky legs and proportionately large feet equipped with well-developed claws that enable it to be very adept at digging.

The striped skunk (Fig. 1) is characterized by prominent, lateral white stripes that run down its back. Its fur is otherwise jet black. Striped skunks are the most abundant of the four species. The body of the striped skunk is about the size of an ordinary house cat (up to 29 inches [74 cm] long and weighing about 8 pounds [3.6 kg]). The spotted skunk (Fig. 1) is smaller (up to 21 inches [54 cm] long and weighing about 2.2 pounds [1 kg]), more weasel-like, and is readily distinguishable by white spots and short, broken white stripes in a dense jet-black coat.



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The hooded skunk (*Mephitis macroura*) is identified by hair on the neck that is spread out into a ruff. It is 28 inches (71 cm) long and weighs the same as the striped skunk. It has an extremely long tail, as long as the head and body combined. The back and tail may be all white, or nearly all black, with two white side stripes. The hog-nosed skunk (*Conepatus leucontus*) has a long snout that is hairless for about 1 inch (2.5 cm) at the top. It is 26 inches (66 cm) long and weighs 4 pounds (1.8 kg). Its entire back and tail are white and the lower sides and belly are black. Skunks have the ability to discharge nauseating musk from the anal glands and are capable of several discharges, not just one.

Range

The striped skunk is common throughout the United States and Canada (Fig. 2a). Spotted skunks are uncommon in some areas, but distributed throughout most of the United States and northern Mexico (Fig 2b). The hooded skunk and the hog-nosed skunk are much less common than striped and spotted skunks. Hooded skunks are limited to southwestern New Mexico and western Texas. The hog-nosed skunk is found in southern Colorado, central and southern New Mexico, the southern half of Texas, and northern Mexico.

General Biology, Reproduction, and Behavior

Adult skunks begin breeding in late February. Yearling females (born in the preceding year) mate in late March. Gestation usually lasts 7 to 10 weeks. Older females bear young during the first part of May, while yearling females bear young in early June. There is usually only 1 litter annually. Litters commonly consist of 4 to 6 young, but may have from 2 to 16. Younger or smaller females have smaller litters than older or larger

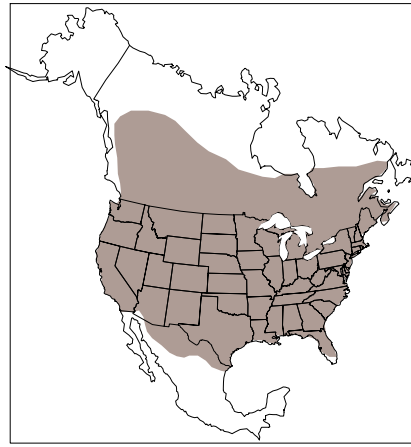


Fig. 2a. Range of the striped skunk in North America.

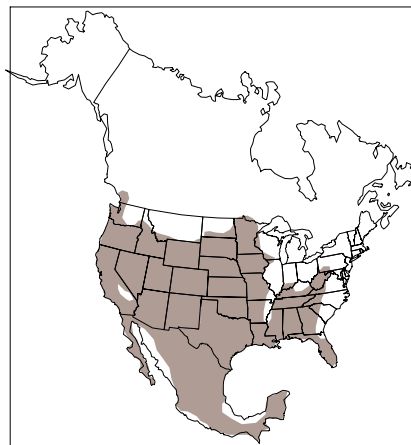


Fig. 2b. Range of the spotted skunk in North America.

females. The young stay with the female until fall. Both sexes mature by the following spring. The age potential for a skunk is about 10 years, but few live beyond 3 years in the wild.

The normal home range of the skunk is 1/2 to 2 miles (2 to 5 km) in diameter. During the breeding season, a male may travel 4 to 5 miles (6.4 to 8 km) each night.

Skunks are dormant for about a month during the coldest part of winter. They may den together in winter for warmth, but generally are not sociable. They are nocturnal in habit, rather slow-moving and deliberate, and have great confidence in defending themselves against other animals.

Habitat

Skunks inhabit clearings, pastures, and open lands bordering forests. On prairies, skunks seek cover in the thickets and timber fringes along streams. They establish dens in hollow logs or may climb trees and use hollow limbs.

Food Habits

Skunks eat plant and animal foods in about equal amounts during fall and winter. They eat considerably more animal matter during spring and summer when insects, their preferred food, are more available. Grasshoppers, beetles, and crickets are the adult insects most often taken. Field and house mice are regular and important items in the skunk diet, particularly in winter. Rats, cottontail rabbits, and other small mammals are taken when other food is scarce.

Damage and Damage Identification

Skunks become a nuisance when their burrowing and feeding habits conflict with humans. They may burrow under porches or buildings by entering foundation openings. Garbage or refuse left outdoors may be disturbed by skunks. Skunks may damage beehives by attempting to feed on bees. Occasionally, they feed on corn, eating only the lower ears. If the cornstalk is knocked over, however, raccoons are more likely the cause of damage. Damage to the upper ears of corn is indicative of birds, deer, or squirrels. Skunks dig holes in lawns, golf courses, and gardens to search for insect grubs found in the soil. Digging normally appears as small, 3- to 4-inch (7- to 10-cm) cone-shaped holes or patches of up-turned earth. Several other animals, including domestic dogs, also dig in lawns.

Skunks occasionally kill poultry and eat eggs. They normally do not climb fences to get to poultry. By contrast,

rats, weasels, mink, and raccoons regularly climb fences. If skunks gain access, they will normally feed on the eggs and occasionally kill one or two fowl. Eggs usually are opened on one end with the edges crushed inward. Weasels, mink, dogs and raccoons usually kill several chickens or ducks at a time. Dogs will often severely mutilate poultry. Tracks may be used to identify the animal causing damage. Both the hind and forefeet of skunks have five toes. In some cases, the fifth toe may not be obvious. Claw marks are usually visible, but the heels of the forefeet normally are not. The hindfeet tracks are approximately 2 1/2 inches long (6.3 cm) (Fig. 3). Skunk droppings can often be identified by the undigested insect parts they contain. Droppings are 1/4 to 1/2 inch (6 to 13 mm) in diameter and 1 to 2 inches (2.5 to 5 cm) long.

Odor is not always a reliable indicator of the presence or absence of skunks. Sometimes dogs, cats, or other animals that have been sprayed by skunks move under houses and make owners mistakenly think skunks are present.

Rabies may be carried by skunks on occasion. Skunks are the primary carriers of rabies in the Midwest. When rabies outbreaks occur, the ease with which rabid animals can be contacted increases. Therefore, rabid skunks are prime vectors for the spread of the virus. Avoid overly aggressive skunks that approach without hesitation. Any skunk showing abnormal behavior, such as daytime activity, may be rabid and should be treated with caution. Report suspicious behavior to local animal control authorities.

Legal Status

Skunks are classified as nongame mammals in California.

See California statutes and regulations regarding the take of furbearing and nongame mammals.

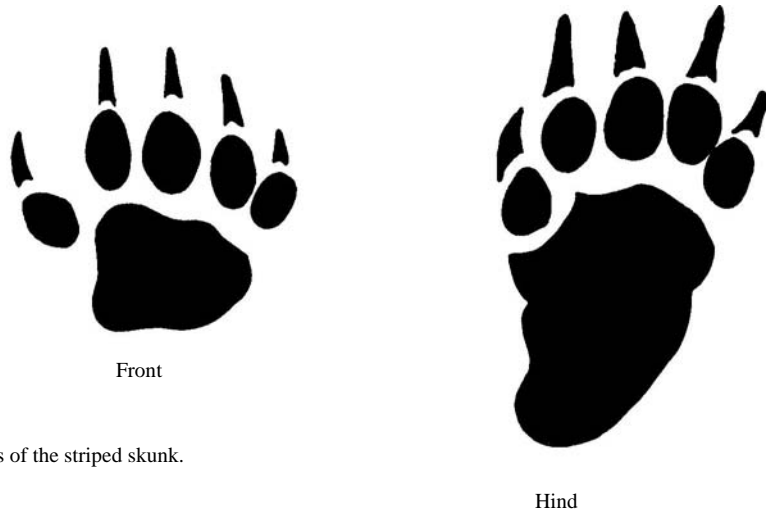


Fig. 3. Tracks of the striped skunk.

Damage Prevention and Control Methods

Exclusion

Keep skunks from denning under buildings by sealing off all foundation openings. Cover all openings with wire mesh, sheet metal, or concrete. Bury fencing 1 1/2 to 2 feet (0.4 to 0.6 m) where skunks can gain access by digging. Seal all ground-level openings into poultry buildings and close doors at night. Poultry yards and coops without subsurface foundations may be fenced with 3-foot (1-m) wire mesh fencing. Bury the lowest foot (0.3 m) of fencing with the bottom 6 inches (15.2 cm) bent outward from the yard or building. Skunks can be excluded from window wells or similar pits with mesh fencing. Place beehives on stands 3 feet (1 m) high. It may be necessary to install aluminum guards around the bases of hives if skunks attempt to climb the supports. Skunks, however, normally do not climb. Use tight-fitting lids to keep skunks out of garbage cans.

Habitat Modification

Properly dispose of garbage or other food sources that will attract skunks. Skunks are often attracted to rodents living in barns, crawl spaces, sheds, and garages. Rodent control programs may be necessary to eliminate this attraction.

Debris such as lumber, fence posts, and junk cars provide shelter for skunks, and may encourage them to use an area. Clean up the area to discourage skunks.

Frightening

Lights and sounds may provide temporary relief from skunk activity.

Repellents

There are no registered repellents for skunks. Most mammals, including skunks, can sometimes be discouraged from entering enclosed areas with moth balls or moth flakes (naphthalene). This material needs to be used in sufficient quantities and replaced often if it is to be effective. Ammonia-soaked cloths may also repel skunks. Repellents are only a temporary measure. Permanent solutions require other methods.

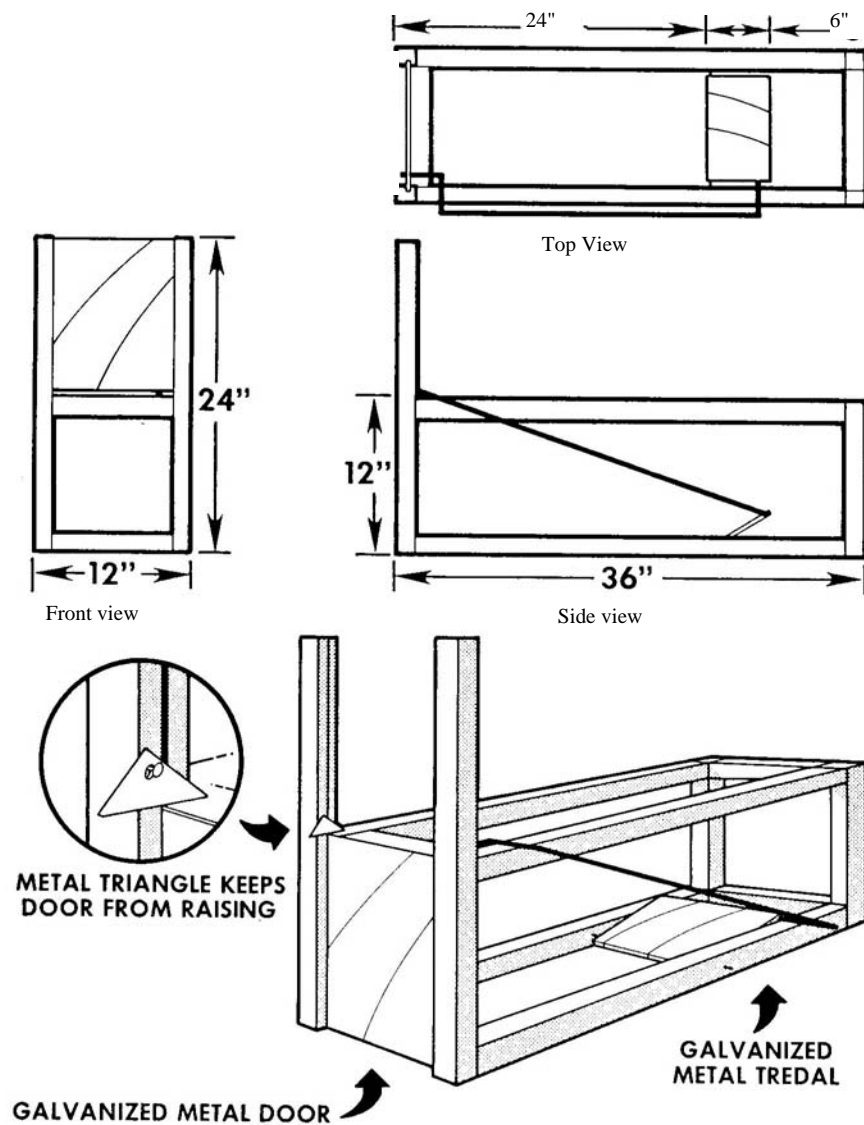


Fig. 4. A box trap can be easily built using scrap lumber and small-mesh, welded-wire fencing.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Box Traps. Skunks can be caught in live traps set near the entrance to their den. When a den is used by more than one animal, set several traps to reduce

capture time. Live traps can be purchased or built. Figures 4 and 5 illustrate traps that can be built easily. Consult state wildlife agency personnel before trapping skunks.

Use canned fish-flavored cat food to lure skunks into traps. Other food baits such as peanut butter, sardines, and chicken entrails are also effective. Before setting live traps, cover them with canvas to reduce the chances of a trapped skunk discharging its scent. The canvas creates a dark, secure environment for the animal. Always approach a trap slowly and quietly to prevent upsetting a trapped skunk.

Gently remove the trap from the area and immediately release the skunk on the property where trapped or kill the trapped skunk.

If the skunk is to be killed, the US Department of Agriculture recommends shooting or euthanization with CO₂.

Shooting

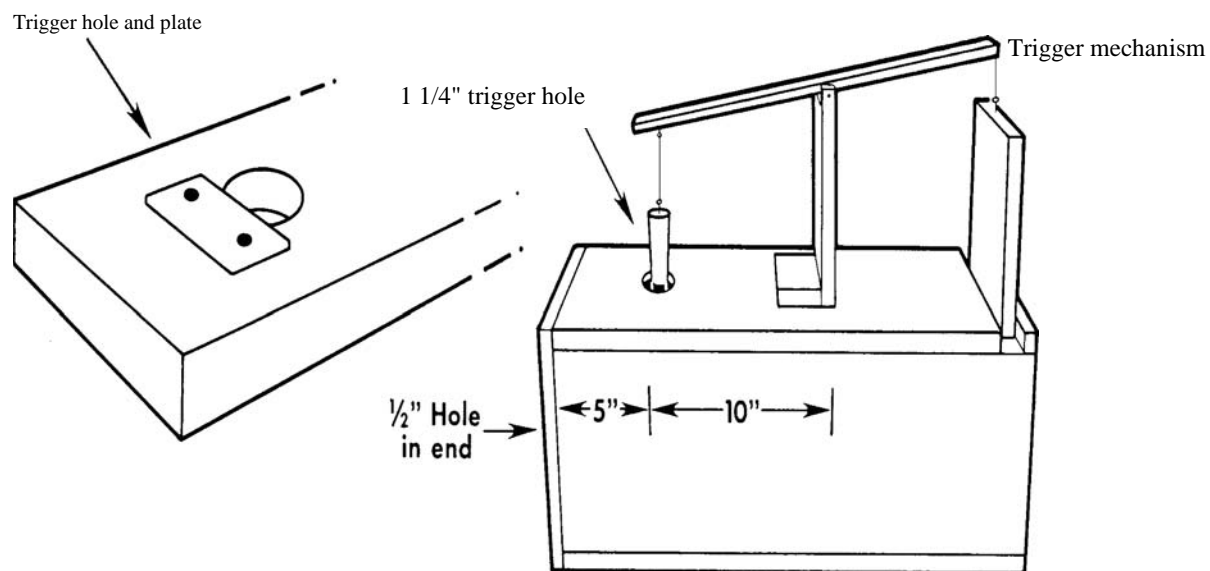
Skunks caught in traps may be shot. Shooting the skunk in the middle of the back to sever the spinal cord and paralyze the hind quarters may prevent the discharge of scent. Shooting in the back should be followed immediately by shooting in the head. Most people who shoot trapped skunks should expect a scent discharge.

Other Methods

Skunk Removal. The following steps are suggested for removing skunks already established under buildings.

1. Seal all possible entrances along the foundation, but leave the main burrow open.
2. Sprinkle a layer of flour 2 feet (0.6 m) in circumference on the ground in front of the opening.
3. After dark, examine the flour for tracks which indicate that the skunk has left to feed. If tracks are not present, reexamine in an hour.
4. After the den is empty, cover the remaining entrance immediately.
5. Reopen the entrance the next day for 1 hour after dark to allow any remaining skunks to exit before permanently sealing the entrance.

A wooden door suspended from wire can be improvised to allow skunks to leave a burrow but not to reenter. Burrows sealed from early May to



Side view

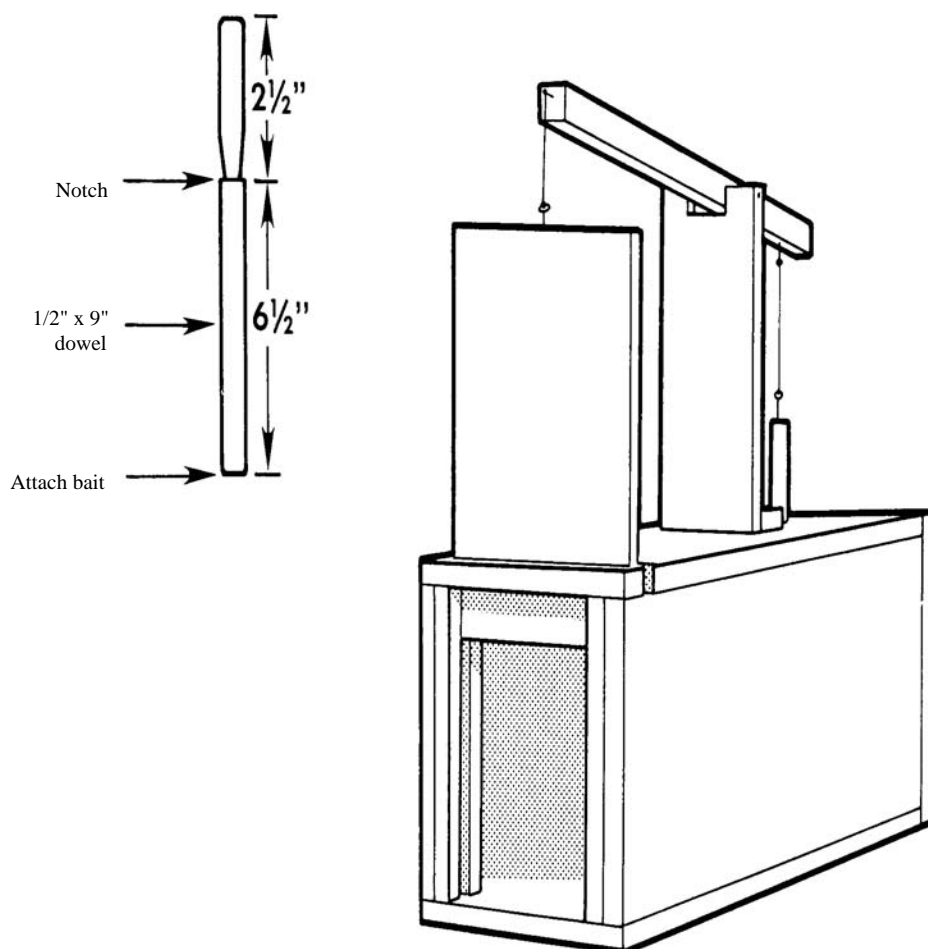


Fig. 5. Alternate design for a box trap.

mid-August may leave young skunks trapped in the den. If these young are mobile they can usually be box-trapped easily using the methods previously described. Where skunks have entered a garage, cellar, or house, open the doors to allow the skunks to exit on their own. Do not prod or disturb them. Skunks trapped in cellar window wells or similar pits may be removed by nailing cleats at 6-inch (15-cm) intervals to a board. Lower the board into the well and allow the skunk to climb out on its own. Skunks are mild-tempered animals that will not defend themselves unless they are cornered or harmed. They usually provide a warning before discharging their scent, stamping their forefeet rapidly and arching their tails over their backs. Anyone experiencing such a threat should retreat quietly and slowly. Loud noises and quick, aggressive actions should be avoided.

Odor Removal. Many individuals find the smell of skunk musk nauseating. The scent is persistent and difficult to remove. Diluted solutions of vinegar or tomato juice may be used to eliminate most of the odor from people, pets, or clothing. Clothing may also be soaked in weak solutions of household chloride bleach or ammonia. On camping trips, clothing can be smoked over a cedar or juniper fire. Neutroleum alpha is a scent-masking solution that can be applied to the sprayed area to reduce the odor. It is available through some commercial cleaning suppliers and the local USDA-APHIS-ADC office. Walls or structural areas that have been sprayed by skunks can be washed down with vinegar or tomato juice solutions or sprayed with neutroleum alpha. Use ventilation fans to speed up the process of odor dissipation. Where musk has entered the eyes, severe

burning and an excessive tear flow may occur. Temporary blindness of 10 or 15 minutes may result. Rinse the eyes with water to speed recovery.

Economics of Damage and Control

Skunks should not be needlessly destroyed. They are highly beneficial to farmers, gardeners, and landowners because they feed on large numbers of agricultural and garden pests. They prey on field mice and rats, both of which may girdle trees or cause health problems. Occasionally they eat moles, which cause damage to lawns, or insects such as white grubs, cutworms, potato beetle grubs, and other species that damage lawns, crops, or hay.

Skunks occasionally feed on ground-nesting birds, but their impact is usually minimal due to the large abundance of alternative foods. Skunks also feed on the eggs of upland game birds and waterfowl. In waterfowl production areas, nest destruction by egg-seeking predators such as skunks can significantly reduce reproduction. The occasional problems caused by the presence of skunks are generally outweighed by their beneficial habits. Some people even allow skunks to den under abandoned buildings or woodpiles. Unless skunks become really bothersome, they should be left alone. An economic evaluation of the feeding habits of skunks shows that only 5% of the diet is made up of items that are economically valuable to people.

The hide of the skunk is tough, durable, and able to withstand rough use. Generally there is little market for skunk pelts but when other furbearer prices are high, skunks are worth pelting.

Acknowledgments

Much of the information for this chapter was based on a publication by F. Robert Henderson.

Figures 1 and 2 from Schwartz and Schwartz (1981).

Figures 3 through 5 by Jerry Downs, Graphic Artist, Cooperative Extension Service, New Mexico State University.

For Additional Information

- Burt, W. H., and R. P. Grossenheider. 1976. A field guide to the mammals, 3d ed. Houghton Mifflin Co., Boston. 289 pp.
- Deems, E. F., Jr., and D. Pursley, eds. 1983. North American furbearers: a contemporary reference. Int. Assoc. Fish Wildl. Agencies and Maryland Dep. Nat. Resour. 223 pp.
- Godin, A. J. 1982. Striped and hooded skunks. Pages 674-687 in J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore, Maryland.
- Howard, W. E., and R. E. Marsh. 1982. Spotted and hog-nosed skunks. Pages 664-673 in J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore, Maryland.
- Rosatte, Richard C. 1987. Striped, spotted, hooded, and hog-nosed skunk. Pages 598-613 in M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Nat. Resour., Ontario, Canada.

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WEASELS

Fig. 1. Least weasel, *Mustela nivalis* (left); Short-tailed weasel, *M. erminea*, in summer coat (middle); Short-tailed weasel in winter coat (right).



Damage Prevention and Control Methods

Exclusion

Block all entrances 1 inch (2.5 cm) or larger with 1/2-inch (1.3-cm) hail screen or similar materials.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Other Methods

Not applicable or effective.

Identification

Weasels belong to the Mustelidae family, which also includes mink, martens, fishers, wolverines, badgers, river otters, black-footed ferrets, and four species of skunks. Although members of the weasel family vary in size and color (Fig. 1), they usually have long, slender bodies, short legs, rounded ears, and anal scent glands. A weasel's hind legs are barely more than half as long as its body (base of head to base of tail). The weasel's forelegs also are notably short. These short legs on a long, slender body may account for the long-tailed weasel's (*Mustela*

frenata) distinctive running gait. At every bound the long body loops upward, reminding one of an inchworm.

In the typical bounding gait of the weasel, the hind feet register almost, if not exactly, in the front foot impressions, with the right front foot and hind feet lagging slightly behind. The stride distance normally is about 10 inches (25 cm).

Male weasels are distinctly larger than females. The long-tailed and short-tailed (*M. erminea*) weasels have a black tip on their tails, while the least weasel (*M. nivalis*) lacks the black tip



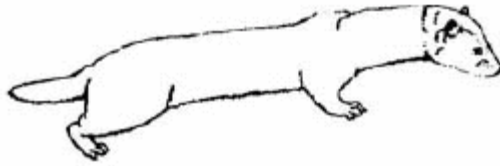
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Fig. 2. Identification of the weasels.

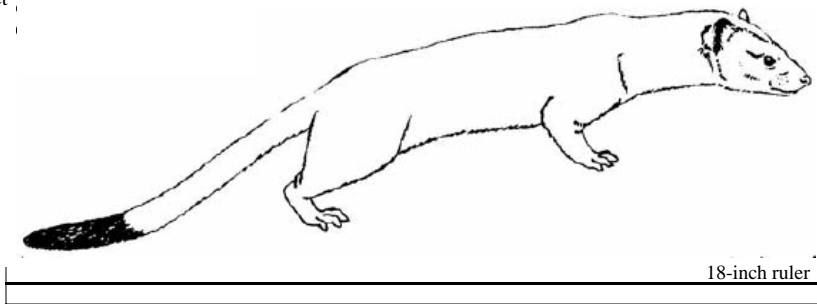
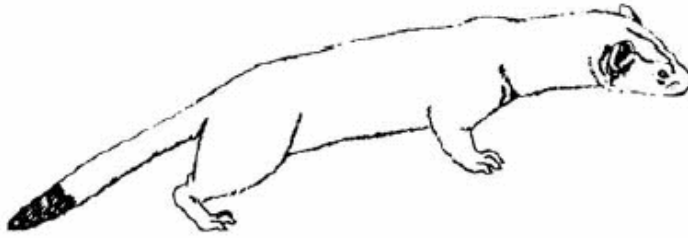
Least weasel, *Mustela nivalis*

- 8 inches long; 2 1/2 ounces in weight
- short tail without black tip
- white feet



Short-tailed weasel, *M. erminea*

- 13 inches long; 6 ounces in weight
- black tip on tail
- white feet



Long-tailed weasel, *M. frenata*

- 16 inches long; 12 ounces in weight
- black tip on tail
- brown feet

(Fig. 2). The long-tailed weasel sometimes is as long as 24 inches (61 cm). The short-tailed weasel is considerably smaller, rarely longer than 13 inches (33 cm) and usually weighing between 3 and 6 ounces (87 and 168 g). Just as

its common name implies, the least weasel is the smallest, measuring only 7 or 8 inches (18 to 20 cm) long and weighing 1 to 2 1/2 ounces (28 to 70 g). Many people assume the least weasel is a baby weasel since it is so small.

Range

Three species of weasels live in North America. The most abundant and widespread is the long-tailed weasel. Some that occur in parts of Kansas, Oklahoma, Texas, and New Mexico have a dark "mask" and are often called bridled weasels. The short-tailed weasel occurs in Canada, Alaska, and the northeastern, Great Lakes, and northwestern states, while the least weasel occurs in Canada, Alaska, and the northeastern and Great Lakes states (Fig. 3).

Habitat

Some authors report finding weasels only in places with abundant water, although small rodents, suitable as food, were more abundant in surrounding habitat. Weasels are commonly found along roadsides and around farm buildings. The absence of water to drink is thought to be a limiting factor (Henderson and Stardom 1983).

A typical den has two surface openings about 2 feet (61 cm) apart over a burrow that is 3 to 10 feet (0.9 to 3 m) long. Other weasel dens have been found in the trunk of an old uprooted oak, in a bag of feathers, in a threshing machine, in the trunk of a hollow tree, in an old mole run, a gopher burrow, and a prairie dog burrow (Henderson and Stardom 1983).

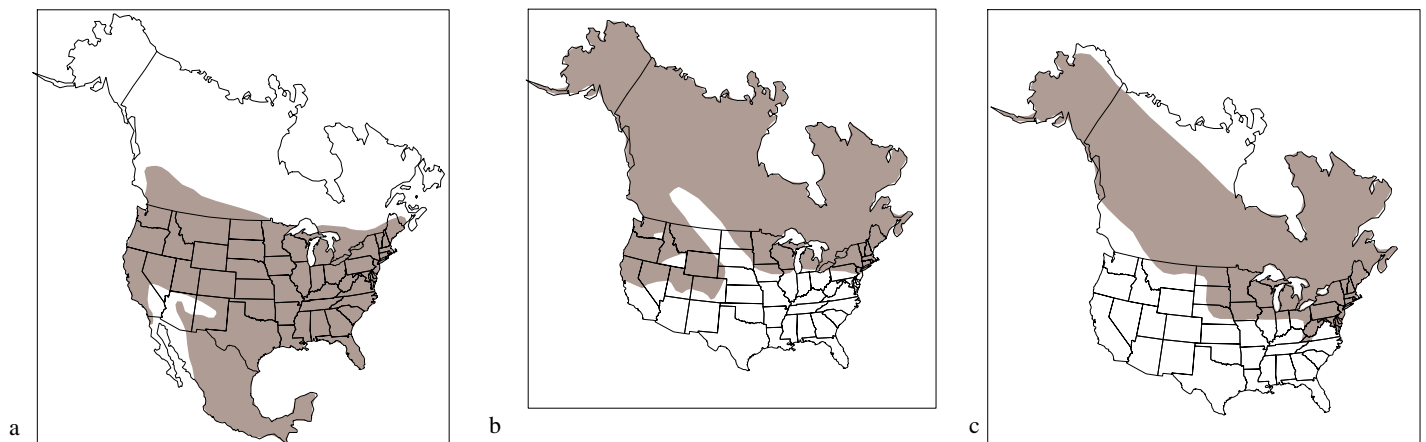


Fig. 3. Range of the (a) long-tailed weasel, (b) short-tailed weasel, and (c) least weasel in North America.

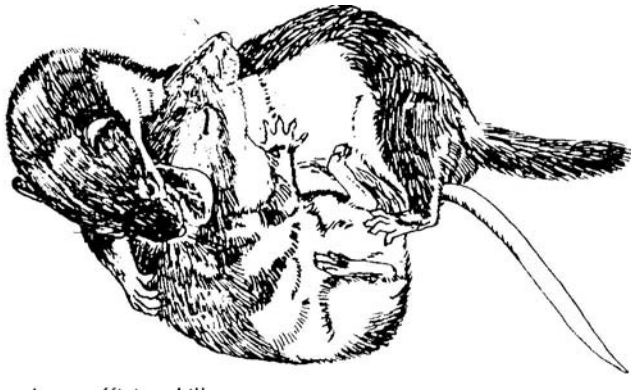


Fig. 4. Weasels are efficient killers, preying on mice as well as on pocket gophers, birds, and other animals.

Food Habits

The weasel family belongs to the order Carnivora. With the exception of the river otter, all members of the weasel family feed primarily on insects and small rodents (Fig. 4). Their diet consists of whatever meat they can obtain and may include birds and bird eggs.

As predators, they play an important role in the ecosystem. Predators tend to hunt the most abundant prey, turning to another species if the numbers of the first prey become scarce. In this way, they seldom endanger the long-term welfare of the animal populations they prey upon.

Long-tailed weasels typically prey on one species that is continually available. The size of the prey population varies from year to year and from season to season. At times, weasels will kill many more individuals of a prey species than they can immediately eat. Ordinarily, they store the surplus for future consumption, much the same as squirrels gather and store nuts.

Pocket gophers are the primary prey of long-tailed weasels. In some regions these gophers are regarded as nuisances because they eat alfalfa plants in irrigated meadows and native plants in mountain meadows where livestock graze. Because of its predation on pocket gophers and other rodents, the long-tailed weasel is sometimes referred to as the farmer's best friend. This statement, however, is

an oversimplification of a biological relationship.

Weasels prefer a constant supply of drinking water. The long-tailed weasel drinks up to 0.85 fluid ounces (26 ml) daily.

General Biology, Reproduction, and Behavior

Weasels are active in both winter and summer; they do not hibernate. Weasels are commonly thought to be nocturnal but evidence indicates they are more diurnal in summer than in winter.

Home range sizes vary with habitat, population density, season, sex, food availability, and species (Svendsen 1982). The least weasel has the smallest home range. Males use 17 to 37 acres (7 to 15 ha), females 3 to 10 acres (1 to 4 ha). The short-tailed weasel is larger than the least weasel and has a larger home range. Male short-tailed weasels use an average of 84 acres (34 ha), and females 18 acres (7 ha), according to snow tracking.

The long-tailed weasel has a home range of 30 to 40 acres (12 to 16 ha), and males have larger home ranges in summer than do females. The weasels appear to prefer hunting certain coverts with noticeable regularity but rarely cruise the same area on two consecutive nights.

Weasel population densities vary with season, food availability, and species. In favorable habitat, maximum densities of the least weasel may reach 65 per square mile (169/km)²; the short-tailed weasel, 21 per square mile (54/km)²; and the long-tailed weasel, 16 to 18 per square mile (40 to 47/km)². Population densities fluctuate considerably with year-to-year changes in small mammal abundance, and densities differ greatly among habitats.

Weasels, like all mustelids, produce a pungent odor. When irritated, they discharge the odor, which can be detected at some distance (Jackson 1961).

Long-tailed weasels mate in late summer, mostly from July through August. Females are induced ovulators and will remain in heat for several weeks if they are not bred. There is a long delay in the implantation of the blastocyst in the uterus, and the young are born the following spring, after a gestation period averaging 280 days. Average litters consist of 6 young, but litters may include up to 9 young. The young are blind at birth and their eyes open in about 5 weeks. They mature rapidly and at 3 months of age the females are fully grown. Young females may become sexually mature in the summer of their birth year.

Damage and Damage Identification

Occasionally weasels raid poultry houses at night and kill or injure domestic fowl. They feed on the warm blood of victims bitten in the head or neck. Rat predation on poultry usually differs in that portions of the body may be eaten and carcasses dragged into holes or concealed locations.

Legal Status

Weasels are designated nongame mammals in California.

See California statutes and regulations regarding the take of furbearing and nongame mammals.

Damage Prevention and Control Methods

Exclusion

Weasels can be excluded from poultry houses and other structures by closing all openings larger than 1 inch (2.5 cm). To block openings, use 1/2-inch (1.3-cm) hardware cloth, similar wire mesh, or other materials.

Trapping

Body-gripping traps are illegal for use in commercial fur or recreational application in California (see regulations).

There are zones throughout California where the use of Conibear-type traps and snares, except those totally submerged, and deadfall traps are prohibited for the protection of the San Joaquin kit fox and Sierra Nevada red fox (see regulations).

Weasels can be captured in live traps with fresh meat as suitable bait.

Economics of Damage and Control

Svendsen (1982) writes:

"Overall, weasels are more of an asset than a liability. They eat quantities of rats and mice that otherwise would eat and damage additional crops and produce. This asset is partially counter-balanced by the beneficial animals and game species. The killing of domestic poultry may come only after the rat population around the farmyard is diminished. In fact, rats may have destroyed more poultry than the weasel. In most cases, a farmer lives with weasels on the farm for years without realizing that they are even there, until they kill a chicken."

Acknowledgments

Figures 1, 2, and 4 adapted by Jill Sack Johnson from "WeaselFamilyofAlberta"(no date), Alberta Fish and Wildlife Division, Alberta Energy and NaturalResources, Edmonton (with permission).

Figure 3 adapted from Burt and Grossenheider (1976) by Jill Sack Johnson.

For Additional Information

Burt, W. H., and R. P. Grossenheider. 1976. A field guide to the mammals, 3d ed. Houghton Mifflin Co., Boston. 289 pp.

Fitzgerald, B. M. 1977. Weasel predation on a cyclic population of the montane vole (*Microtus montanus*) in California. J. An. Ecol. 46:367-397.

Glover, F. A. 1942. A population study of weasels in Pennsylvania. M.S. Thesis, Pennsylvania State Univ. University Park. 210 pp.

Hall, E. R. 1951. American weasels. Univ. Kansas Museum Nat. Hist. Misc. Publ. 4:1-466.

Hall, E. R. 1974. The graceful and rapacious weasel. Nat. Hist. 83(9):44-50.

Hamilton, W. J., Jr. 1933. The weasels of New York. Am. Midl. Nat. 14:289-337.

Henderson, F. R., and R. P. Stardom. 1983. Short-tailed and long-tailed weasel. Pages 134-144 in E. F. Deems, Jr. and D. Purseley, eds. North American furbearers: a contemporary reference. Internatl. Assoc. Fish Wildl. Agencies Maryland Dep. Nat. Resour.

Jackson, H. H. T. 1961. Mammals of Wisconsin. Univ. Wisconsin Press, Madison. 504 pp.

King, C. M. 1975. The home range of the weasel (*Mustela nivalis*) in an English woodland. J. An. Ecol. 44:639-668.

MacLean, S. F., Jr., B. M. Fitzgerald, and F. A. Pitelka. 1974. Population cycles in arctic lemmings: winter reproduction and predation by weasels. Arctic Alpine Res. 6:1-12.

Polderboer, E. B., L. W. Kuhn, and G. O. Hendrickson. 1941. Winter and spring habits of weasels in central Iowa. J. Wildl. Manage. 5:115-119.

Quick, H. F. 1944. Habits and economics of New York weasel in Michigan. J. Wildl. Manage. 8:71-78.

Quick, H. F. 1951. Notes on the ecology of weasels in Gunnison County, Colorado. J. Mammal. 32:28-290.

Schwartz, C. W. and E. R. Schwartz. 1981. The Wild mammals of Missouri, rev. ed. Univ. Missouri Press, Columbia. 356 pp.

Svendsen, G. E. 1982. Weasels. Pages 613-628 in J. A. Chapman and G. A. Feldhamer, eds., Wild mammals of North America: biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore, Maryland.

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